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### **Ecosystem-based Approach to Marine Management.**

#### **Overview:**

The essential premise, or assumption, upon which this statement is based is that our knowledge of the marine environment and its ecosystems is very limited, therefore it makes no sense for the ecosystem-based approach to attempt to manage marine ecosystems themselves (as we do not know enough about them), but rather for us to manage the human activities which impact on these ecosystems.

This is a practical approach which takes account of reality. In its most fundamental form it is characterised by the concept of adaptive management i.e. we alter the management regime, which is based on principles of sustainability, in order to ensure that the impact of human activity is minimal or, at least, acceptable.

However, there is another side to this coin. That is the concept of ecosystem integrity. If we are to define what is meant by the terms “minimal” and “acceptable”, then we also have to have a clear idea of how ecosystems function, the principles and needs which they operate under, and therefore what is a tolerable level of impact. Ecosystem integrity, and our definition of it, is therefore an essential yardstick in measuring the nature of the ecosystem-based management approach.

In this statement, therefore, we intend to look at this matter from two perspectives. On the one hand, the principles that adaptive management should observe (one side of the coin). And on the other hand, the principles that define ecosystem integrity (the other side of the coin). Out of these two perspectives we will then attempt to create a synthesis which actually defines the ecosystem-based approach, and thus informs marine managers about how they should assess human activities for their impact and respond in order to protect the marine environment.

#### **Ecosystem Integrity.**

We commence with this perspective because it defines what it is essential to sustain the marine environment from the point of view of the marine environment itself. If the marine environment is not in good health, or we do not know how to measure good health, then whatever management practice we employ will be compromised by the fact that it will have no natural, objective grounding.

The key concept is that all ecosystems have a structure and a method of functioning. The precise structure and method of functioning will vary from case to case, but a number of common principles can be identified.

These common principles are, we suggest:

- A physical environment with specific characteristics. These physical and chemical characteristics shape the nature of the environment, and habitats, available to marine species.
- An ecosystem, in biological terms, is hierarchical in structure and this hierarchy is based on trophic levels i.e. the dynamic between predator and prey, which gives rise to a structured system of dependency between species.
- Certain species in an ecosystem may be regarded as “keystone species” i.e. the presence of a particular species in a physical environment results in the creation of a modified physical habitat (modified by the keystone species) which other species may use for their own survival and upon which they are dependent. On the basis of this modified physical environment, a hierarchical, inter-dependent structure of species (ecosystem) is developed and sustained. The longer this modified physical habitat is able to endure (i.e. is undisturbed by natural catastrophe or human interference) the more complex this ecosystem is likely to become, eventually attaining a “climax condition”.
- Interference with any part of the ecosystem structure (hierarchy) will have a consequence, potentially altering the nature of the ecosystem. Sometimes this interference can be beneficial i.e. giving an opportunity for a species to develop in a manner and extent previously unavailable to it (i.e. creating an evolutionary opportunity), and sometimes this interference can be negative and lead to a collapse and simplification of the hierarchical structure (i.e. a loss of biological diversity). Generally speaking, interference in ecosystem integrity is detrimental rather than beneficial, and certainly so in the short-term.

### **Adaptive Management.**

The key concept in adaptive management is sustainability which, although it has many definitions, means using resources and making use of the environment in a manner which does not compromise the ability of future generations to use those same resources and environment.

It is therefore an exploitative approach to management, and is predicated on the belief that humankind can exploit the environment up to and within certain limits. These limits are known as environmental limits. These limits are defined as boundaries. The boundaries are based on the ability of a biological resource to be regenerative, and on physical sources to be renewable. Where neither regeneration nor renewability are available, because the resource is finite, then the judicious use of the resource so that it survives into the long-term is applied.

Environmental limits are sometimes conflated with the concept of environmental services. In this context, the environment is seen as a resource providing various services and management is required to husband those resources. These resources are viewed either as goods i.e. wild fisheries and minerals, or as systems i.e. climate control and waste assimilation.

The concept of sustainability is further refined into three key parameters: a social (giving access to all in a just and equitable manner), an economic (ensuring that economic activity is not unreasonably restrained so that wealth can be generated and, once that wealth has been generated,

using it, in part, to repair the environmental damage which has been caused by that economic activity), and conservation (taking care to ensure that the biological, genetic and physical structure of the environment is not irreversibly nor unacceptably damaged).

Recent thinking has also extended these three pillars of sustainability (social, economic and environmental) to include the promotion of good governance (i.e. sound management systems and political decision-making) and using good science responsibly (i.e. ensuring that management and decision-making takes place on the basis of good, verifiable evidence).

As a result, decisions on human activities (i.e. how to manage human activities for their impact on the environment and ecosystems) have generally required licences for human activity to pass a sustainability test based on the above criteria. The veracity of this process has depended greatly upon the integrity with which these criteria have been applied, i.e. has the science informing the decision-making been truly sound, and has the voice of all stakeholders been properly heard and assessed.

### **The Ecosystem-based Approach : A Synthesis.**

Ecosystem-based management must have an understanding of the integrity of ecosystems (how they are structured and the principles on which they operate), and must promote research in order to further that understanding. This is one side of the coin.

Ecosystem-based management must require human activities to adapt in the light of evidence, whilst at the same time allowing human activities the freedom to operate whenever and wherever they respect the full dimensions of sustainability. This is the other side of the coin.

In other words, a true ecosystem based-approach must simultaneously understand the nature of ecosystem integrity and allow human activity to exploit resources and the environment in an adaptive, sustainable manner.

How can this be achieved ? How can such a management approach be both the facilitator of human activity, allowing it to grow and exploit the environment, whilst at the same time being the policeman who arrests and prohibits unsustainable behaviour ?

The key lies in, firstly, having a sound understanding of the issues and concepts (scientific and philosophical, theoretical and practical) which are involved. This short summary has tried to identify these issues and concepts. And secondly, lies in making available to this management approach *the tools* with which it can function and deliver.

All professional activity must be properly equipped in order to perform its task, both intellectually and practically. In other words, it must possess the tools with which it can do its job, and it must be skilled in the use of those tools.

We will now try to provide a short summary of the tools that are involved. With respect to the skills required to use those tools, that is a matter for consideration by government and needs to be dealt with separately. At the present time, it is suffice to say that the creation of this level of skill in managers is an essential requisite of the ecosystem-based approach, and without such training/education this management system cannot be delivered.

The tools of the ecosystem-based management approach are:

- A strategy – probably devised at a national level (thus having democratic legitimacy) – which structures overall thinking. A strategy should be based on principles (identified here, see above), and have objectives which are commonly agreed and owned by all stakeholders (democratic legitimacy).
- A set of Environmental Quality Objectives – these are objective, scientifically determined criteria which are democratically owned, and which define the essential requirements or benchmarks for determining the health of the physical and biological components of the marine environment (e.g. dissolved oxygen levels, productivity of keystone species). These environmental quality objectives should be framed for both the over-arching environment (a sea or ocean) and for sub-sets of that environment (the component ecosystems). These environmental quality objectives can further inform such concepts as “good environmental status” (ref. EU Marine Strategy Framework Directive).
- Areas of defined human activity – these are areas of the sea, identified by democratically based planning procedures, which designate the type of human activity which may occur within that area. This tool consists of, on the one hand, a management organisation/agency, empowered to define these areas and the activities which may occur within those areas. And, on the other hand, the instruments of designation (such as “no-take” marine reserves used to regenerate over-exploited fish stocks and other conservation designations) which proscribe the nature of the management regime, along with its objectives, which will operate in those areas.
- A system of monitoring – this being an essential instrument in order to ensure, firstly, that key management decisions are observed by all parties; and secondly, that evidence is gathered to establish how management regimes are operating and how they need to be altered and developed in order to improve their value.
- The precautionary principle – this is a fundamental. Preferably, it should be founded on the principle that no activity is allowed to occur until it can be shown that no damage will result from that activity. It should not be founded on the reverse i.e. any activity may occur until there is reason to believe that it may cause damage, although proof remains unavailable. The former version is a strong interpretation of the principle, the latter a weaker interpretation. Given our present limited knowledge of the marine environment and in order to protect ecosystem integrity, the ecosystem-based management approach should use the strong version. It is upon the strong version of the principle that licences, and their environmental impact assessments, should be founded.

We hope that this short outline of the ecosystem-based approach to marine management, in terms of its key concepts and the tools for its practical implementation, offers a basis for continued discussion and development within the OSPAR process.

We regard the development and delivery of the ecosystem-based approach, as a practical management tool, as one of the key Strategic Objectives for OSPAR’s work following the 2010 Ministerial Meeting.

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